

# Unmasking the silent killer to heart health: An evaluation of cardiometabolic risk and screening in outpatient spinal cord injury rehabilitation

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## **Abstract:**

**Objective:** 1) Determine the prevalence of cardiometabolic disease (CMD) risk factors in Canadian outpatients with spinal cord injury or disease (SCI/D); and 2) Augment CMD screening practices to reflect evidence-based guidelines using quality improvement initiatives.

**Design:** Chart audit of consecutive outpatients with SCI/D assessed after discharge from Parkwood Institute between October 2020 to December 2021 (n=78). Data collected included presence of and evidence-based screening for 4 CMD risk factors – obesity, hypertension, dyslipidemia, diabetes mellitus. Definitions for presence of these 4 CMD risk factors were established using clinical practice guidelines for persons with SCI/D.

**Results:** All CMD risk factors were highly prevalent amongst outpatients with SCI/D. Two of every 5 outpatients had  $\geq 3$  risk factors, indicating the presence of established CMD. Obesity was the most prevalent risk factor (84.2%), followed by dyslipidemia (80.7%), hypertension (47.4%), and diabetes mellitus (44.6%). Outpatient clinic screening for hypertension and obesity across 79 visits (n=43) was completed in 15.2% and 11.4% of appointments respectively.

**Conclusions:** The strikingly high CMD risk factor prevalence in this cohort of Canadian outpatients with SCI/D coupled with low screening rates in follow-up appointments reinforces the need for strategies to reduce preventable harm in the rehabilitation setting.

**Key Words:** cardiometabolic risk factors, metabolic syndrome, spinal cord injuries

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### **Introduction:**

Frequently referred to as a “silent killer”, cardiometabolic disease (CMD) is one of the leading causes of morbidity and mortality in persons with spinal cord injury/disease (SCI/D), yet persons with SCI/D are less likely to receive appropriate screening, diagnosis, and treatment for this preventable condition. Moreover, CMD prevalence in the Canadian SCI/D population and the implementation of targeted evidence-based treatment guidelines in rehabilitation settings have been relatively under-researched.<sup>1-3</sup> CMD encompasses a cluster of interrelated health risk factors that often develop slowly and insidiously without overt symptoms and therefore may not be a priority in rehabilitation, particularly when compared to more acute, symptomatic complications.<sup>1-4</sup> As such, early detection and timely treatment will require conscientious efforts to bring CMD risk reduction to the forefront before it is too late.

CMD is defined as the co-occurrence of 3 or more interrelated chronic conditions—obesity, hypertension, dyslipidemia, and diabetes mellitus—which collectively contribute to the development of diabetes mellitus, cardiovascular disease, and/or heart failure.<sup>1,3,5</sup> It is comprised of inflammatory, renal, metabolic, and prothrombotic pathologies leading to serious complications in essential regulatory processes in the body.<sup>1,5</sup> The complex, multisystem nature of SCI/D, impairments in the autonomic nervous system controlling involuntary homeostatic processes, in combination with other factors related to lifestyle changes (i.e., physical inactivity and decreased energy expenditure) have led many studies to report a heightened prevalence of CMD risk and its related consequences in the SCI/D population.<sup>3,4,6</sup> Evidence has also shown that persons with SCI/D develop

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CMD at an accelerated rate and younger age in comparison to the non-SCI/D population.<sup>7</sup>

Interrelated conditions contributing to the development of CMD have been identified as key clinical determinants for prediction and/or diagnosis; the most well-known of these are hypertension, obesity, dyslipidemia, and diabetes mellitus.<sup>1,3</sup> Recently published clinical practice guidelines, “Identification and Management of Cardiometabolic Risk after Spinal Cord Injury,” deliver guidance on evaluating these 4 key CMD risk factors in persons with SCI/D, specifically by providing rationale on identifiable biomarkers, methods for risk stratification, and recommendations for routine screening.<sup>1</sup> In particular, the screening of all 4 risk factors is recommended during inpatient rehabilitation, with routine tests in the outpatient setting to be completed at every visit for hypertension and obesity and on an annual basis for dyslipidemia and diabetes mellitus.<sup>1</sup> Evaluating the gap between current practices and guideline recommendations is essential to identify gaps in care and areas for improvement.<sup>8</sup> As such, the purpose of this study was to evaluate the prevalence of CMD risk factors in a Canadian sample of outpatients with SCI/D at Parkwood Institute, determine the current rate of guidelines-based screening, and identify areas for improvement in institutional screening practices to inform targeted quality improvement strategies promoting heart health.

**Ethics:**

This study underwent institutional Research Ethics Board (REB) evaluation and received REB exemption as a quality improvement initiative.

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### **Methods:**

A retrospective chart review was conducted on a convenience sample of consecutive outpatients with traumatic and non-traumatic SCI/D who were seen for an initial assessment at the Parkwood Institute outpatient clinic after discharge from inpatient rehabilitation between October 2020 to December 2021. Data collected included age, sex, and clinical data related to the prevalence at admission to and/or discharge from inpatient rehabilitation for the 4 key CMD risk factors – hypertension, obesity, dyslipidemia, diabetes mellitus.. Hypertension and obesity were assessed using blood pressure (systolic/diastolic) and body mass index (BMI) measurements, respectively. Dyslipidemia and diabetes mellitus were evaluated using data from lipid and glycated hemoglobin (HbA1c) blood tests conducted upon admission into inpatient SCI/D rehabilitation as part of standard care at Parkwood Institute. Levels of high-density lipoprotein cholesterol (HDL-C) and triglycerides (TG) were collected to establish the diagnoses of dyslipidemia, and HbA1c and fasting plasma glucose (FPG) values were used to establish the diagnosis of diabetes mellitus. Cut-offs determined by published clinical practice guidelines were used for risk stratification.<sup>1</sup> Obesity and hypertension screening documented during outpatient clinic appointments was collected to evaluate screening practices at Parkwood Institute.

### *Definitions:*

**Obesity:** The World Health Organization classifies a BMI of  $>30 \text{ kg/m}^2$  as the obesity cut-off for the non-SCI/D population. However, SCI/D clinical practice guidelines recommend the use of a reduced cut-off of  $>22 \text{ kg/m}^2$  to reflect changes in body

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composition in persons with SCI/D.<sup>1</sup> Accordingly, obesity was defined as a BMI > 22kg/m<sup>2</sup>.

Hypertension: Consistent with SCI/D clinical practice guidelines, blood pressure readings of systolic > 130 mmHg and diastolic > 85 mmHg were used to define hypertension.<sup>1</sup>

Dyslipidemia: Dyslipidemia was defined as serum triglycerides >1.7mmol/L, or HDL-C levels < 1.03 mmol/L or < 1.29 mmol/L for men and women, respectively, as outlined by the SCI/D guidelines<sup>1</sup>

Diabetes Mellitus: Diabetes was defined per the clinical practice guidelines as FPG > 7mmol/L and/or glycated HbA1c > 6.5%, respectively.<sup>1</sup>

CMD: The presence of 3 or more of the above risk factors was considered diagnostic for the presence of CMD, as per the guidelines. <sup>1</sup>

### **Results:**

78 consecutive outpatients with SCI/D at Parkwood Institute were evaluated for CMD risk factor prevalence. The cohort was mostly male (61.5%) with the average age 57.6 years ( $\pm$  18 SD). All 4 key CMD risk factors were prevalent in the sample, with almost all of the patients having at least one risk factor (94.9%). Even more strikingly, 75.6% had

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at least 2 CMD risk factors and 44.9% had 3 or more (44.9%), meeting the definition of CMD.

*Risk Factor Prevalence:*

Obesity: BMI measurements were available for 76 patients in the sample (97.4%) and was present in 64 (84.2%). Obesity was the most prevalent risk factor, although this may partially be attributed to the low BMI cut-off for persons with SCI/D (BMI > 22 kg/m<sup>2</sup>). An evaluation using the conventional, non-SCI/D cut-off (BMI > 30 kg/m<sup>2</sup>) revealed that 25 patients of the sample (32.9%) met the criteria.<sup>1</sup>

Dyslipidemia: Clinical data from lipid profiles upon inpatient rehabilitation was available for 57 patients (73.1%). Dyslipidemia was the second-most prevalent risk factor, present in 80.7% of patients for whom data was available.

Hypertension: Hypertension screening was completed in 97.4% of patients (n=76). 47.4% of patients met the diagnostic criteria for hypertension .

Diabetes Mellitus: Screening for diabetes with fasting plasma glucose and/or HbA1c was evaluated in 94.9% of patients (n=74). Of these, 44.6% of patients fulfilled diagnostic criteria for diabetes mellitus.

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### *Frequency of Guidelines-Based Screening:*

Current clinical practice guidelines recommend hypertension and obesity screening to be completed at every routine visit and at least annually with ongoing management respectively.<sup>1</sup> However, to establish an overall baseline of screening completion in the outpatient clinic at Parkwood Institute, screening for both hypertension and obesity were assessed for completion at every appointment. Clinic intake forms completed by physiatrists and nursing staff were reviewed to determine whether weight, height, body mass index, and blood pressure were measured and subsequently documented. Phone visits, conducted due to the COVID-19 pandemic, were not included in the evaluation as the virtual nature of the assessment would limit screening without access to blood pressure cuffs and a wheelchair-accessible weighing scale. A review of 79 in-person clinic appointments for 43 outpatients showed that hypertension screening was completed at 9 visits (11.4%) and obesity screening was completed at 12 visits (15.2%). Root cause analysis and focused interviews with key stakeholders within the outpatient clinic staff helped identify that key drivers of low screening rates were attributed to a number of factors ranging from limited time and resources, low prioritization of CMD risk, and to uncertainty about responsibility and appropriate methods for addressing risk if a problem is found.

### **Discussion:**

Two out of every 5 outpatients assessed had > 3 key modifiable CMD risk factors, and almost all had at least one. Despite the strong indication of increased CMD risk among this Canadian SCI/D sample, adherence to screening recommendations in the

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outpatient rehabilitation setting was found to be insufficient for hypertension and obesity in particular. While preliminary efforts to understand the root causes underlying low screening rates have been initiated, crucial next steps lie in building on existing knowledge and developing comprehensive strategies to address specific barriers. One initiative involving revisions to the outpatient clinic intake form to bring CMD risk reduction to the forefront is underway, and an evaluation of screening completion following its implementation will assess the intended outcome of increased screening. Moreover, a patient-centered approach to CMD risk reduction rooted in health promotion may prove to be beneficial to instill long-term risk-minimizing behaviours through the maintenance of healthy lifestyle habits.<sup>9</sup> Components of such interventions may include but are not limited to, targeted patient education, adjusted nutrition recommendations, and physical activity promotion in combination with behavioural components and autonomy in decision-making.<sup>1,9,10</sup> Ultimately, efforts to promote in-house screening for CMD should be coupled with promoting lifestyle changes to reverse the effects of the modifiable risk factors and maintain well-being.

### *Limitations:*

The relatively small sample size of this single-centre initiative provides critical baseline data about the prevalence of CMD risk factors in a Canadian SCI/D sample, consistent with quality improvement methodology. However, results of risk factor prevalence should be interpreted with caution as the single centre and relatively small sample size limit generalizability. Moreover, the accuracy of diagnosing hypertension using admission and discharge blood pressure readings rather than an average of multiple



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results taken across rehab stay has not been established, and this study did not account for the presence or absence of antihypertensive therapy at the time of assessment and therefore this data should be interpreted with caution. Although methodologically sound, one limitation of this initiative is its use of SCI/D-specific cut-offs for establishing diagnosis and prevalence for obesity and dyslipidemia. The use of SCI/D cut-offs for obesity may overestimate the true prevalence of obesity, and the use of only triglyceride and HDL cut-offs for dyslipidemia—and not those for total cholesterol or LDL cholesterol, as in the general population—may underestimate the prevalence of dyslipidemia in this cohort. Although published clinical practice guidelines recommend the use of these cut-offs to facilitate risk stratification, the guidelines and selection of these measures are not without their own limitations.

### *Future Directions:*

Next steps will focus on systematically introducing changes to ensure persons with SCI/D receive appropriate, guidelines-based screening for CMD. As part of an initial quality improvement strategy to address some of these identified root causes, a revised clinic intake form specific to CMD risk management was developed to include key information on the core risk factors, recommended timing for screening, and clinical data from past evaluations to help inform treatment. Although yet to be implemented into practice, uptake of the form may help increase CMD awareness and prioritize prevention in the outpatient clinic setting. Other root causes to low screening brought to attention by staff such as a lack of patient resources for self-directed learning and

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limited means of addressing CMD risk represent additional target areas for future quality improvement initiatives.

### **Conclusions:**

Results from this study show a strikingly high prevalence of CMD risk factors among the sample of Canadian outpatients with SCI/D, yet screening rates far below guideline recommendations in the outpatient clinic setting during follow-up appointments.

Ultimately, this reinforces the urgent need to develop effective quality improvement strategies prioritizing CMD detection and management within the rehabilitation setting.

Further research is needed to develop solutions to barriers and root causes that not only address the physiological impacts of CMD, but also target the potential environmental, behavioural, and lifestyle factors contributing to its development.<sup>8</sup> Efforts to increase awareness of CMD and reinforce best practices will be vital to reducing overall risk and promoting lifelong health in the SCI/D population.

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